

- 5 electrical response characteristic upon exposure at a selected temperature to the individual gas component than each of the other chemo/electro-active materials, the array being situated within the gas mixture, and having a substantially constant temperature of about 400C or more;
- 10 (b) means for determining the electrical response value of each chemo/electro-active material upon exposure of the array to the gas mixture; and
- 15 (c) means for performing an analysis of the individual gas component from the electrical response values.

32. An apparatus according to Claim 31 wherein the component gases in the gas mixture are not separated.

33. An apparatus according to Claim 31 wherein the analysis is performed from the electrical responses of the chemo/electro-active materials upon exposure to the multi-component gas mixture only.
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34. An apparatus according to Claim 31 wherein the means for performing analysis is means for calculating the concentration within the gas mixture of the individual gas component.
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35. An apparatus according to Claim 31 further comprising means for determining a value for the temperature of the gas mixture connected in parallel circuitry with the chemo/elctro-active materials, and wherein the individual gas component is analyzed from digitized electrical responses and a digitized temperature value.
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36. An apparatus according to Claim 31 wherein at least one chemo/electro-active material, when at a temperature of about 400°C or more, (i) has an electrical resistivity in the range of about 1 ohm-cm to about 10^5 ohm-cm, and (ii) exhibits a change in electrical resistance of at least about 0.1 percent
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upon exposure of the material to an individual gas component, as compared to the resistance before exposure.

37. An apparatus according to Claim 31 wherein the electrical response characteristic of each material upon exposure to the gas mixture at a selected temperature is quantifiable as a value, and the response value of at least one material is constant or varies by no more than about twenty percent during exposure of the material to an individual gas component at the selected temperature for a period of at least about one minute.

38. An apparatus according to Claim 31 wherein the electrical response is selected from the group consisting of resistance, impedance, capacitance, voltage or current.

39. An apparatus according to Claim 31 wherein at least one chemo/electro-active material is a metal oxide.

40. An apparatus for analyzing at least one individual gas component in a multi-component gas mixture, comprising:

- (a) an array of first and second chemo/electro-active materials, each chemo/electro-active material having a different electrical response characteristic upon exposure at a selected temperature to the individual gas component than each of the other chemo/electro-active materials, wherein the chemo/electro-active materials are selected from the pairings in the group consisting of
 - (i) the first material is M^1O_x , and the second material is $M^1_aM^2_bO_x$;
 - (ii) the first material is M^1O_x , and the second material is $M^1_aM^2_bM^3_cO_x$;

- (iii) the first material is $M^1_a M^2_b O_x$, and the second material is $M^1_a M^2_b M^3_c O_x$;
- (iv) the first material is a first $M^1 O_x$, and the second material is a second $M^1 O_x$;
- 5 (v) the first material is a first $M^1_a M^2_b O_x$, and the second material is a second $M^1_a M^2_b O_x$; and
- (vi) the first material is a first $M^1_a M^2_b M^3_c O_x$, and the second material is a
- 10 second $M^1_a M^2_b M^3_c O_x$;
- wherein M^1 is selected from the group consisting of Ce, Co, Cu, Fe, Ga, Nb, Ni, Pr, Ru, Sn, Ti, Tm, W, Yb, Zn, and Zr; M^2 and M^3 are each independently selected from the group consisting of Al, Ba, Bi, Ca, Cd, Ce, Co, Cr,
- 15 Cu, Fe, Ga, Ge, In, K, La, Mg, Mn, Mo, Na, Nb, Ni, Pb, Pr, Rb, Ru, Sb, Sc, Si, Sn, Sr, Ta, Ti, Tm, V, W, Y, Yb, Zn, and Zr, but M^2 and M^3 are not the same in $M^1_a M^2_b M^3_c O_x$; a, b and c are each independently about 0.0005 to about 1, provided that $a+b+c = 1$; and x is a
- 20 number sufficient so that the oxygen present balances the charges of the other elements in the compound;
- (b) means for determining the electrical response of each chemo/electro-active material upon exposure of the array to the
- 25 gas mixture; and
- (c) means for performing an analysis of the individual gas component from the electrical responses.
41. An apparatus according to Claim 40 wherein
- 30 (a) $M^1 O_x$ is selected from the group consisting of $Ce_a O_x$, $Co O_x$, $Cu O_x$, $Fe O_x$, $Ga O_x$, $Nb O_x$, $Ni O_x$, $Pr O_x$, $Ru O_x$, $Sn O_x$, $Ta_a O_x$, $Ti O_x$, $Tm O_x$, $W O_x$, $Yb O_x$, $Zn O_x$, $Zr O_x$, $Sn O_x$ with Ag additive, $Zn O_x$ with Ag additive, $Ti O_x$ with
- 35 Pt additive, $Zn O_x$ with frit additive, $Ni O_x$ with frit additive, $Sn O_x$ with frit additive, or $W O_x$ with frit additive;